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Docket No. HTI-101CIP



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Wayne S. Steffier)	
)	
Serial No.:	10/039,991)	Group Art Unit: 1772
)	
Filing Date:	January 8, 2002)	Examiner: Brian P. Egan
)	
Title:	ACTIVELY COOLED)	
	FIBER-REINFORCED COMPOSITE)	
	ROCKET PROPULSION THRUST)	
	CHAMBER AND METHOD)	
)	

DECLARATION OF ROBERT HOLZL
(37 C.F.R. 1.132)

Mail Stop: Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The undersigned, Robert Holzl, declares as follows with respect to the above-identified patent application:

1. My current profession is chemical thermodynamicist and refractory metallurgist.
2. I am a chemical engineering graduate of Princeton University.
3. I received training in mechanical engineering at North Carolina State College and the University of Pittsburgh.
4. I am licensed as a Professional Engineer in Metallurgical Engineering by the State of California, and I have more than 45 years experience in the use and processing of refractory

materials, with a particular emphasis on the application of such refractory materials for nuclear reactors and rocket engines.

5. I was among the first 100 members of the American Rocket Society in which I was elected an Associate Fellow in 1948.

6. I was employed as a Senior Development Engineer at Reactor Motors, Inc., one of the first two private rocket companies in the United States. At Reactor Motors, Inc., I was responsible for developing the first electroformed, regeneratively cooled rocket thrust chamber, a design which has mechanical considerations that are similar to those associated with the combustion chamber described in U.S. Patent No. 6,151,887.

7. Following Reactor Motors, Inc., I was employed as a Senior Engineer at Aerojet, the other one of the first two private rocket companies in the United States. At Aerojet, I was in charge of liquid engine thrust chamber development and new programs proposals for the Liquid Engine Division.

8. Following Aerojet, I founded Turbo Engineering, Inc., which became the largest rocket driven, small gas turbine enterprise in the world.

9. During the later part of my career, I directed the San Fernando Laboratories, where I was responsible for the development of over 400 different CVD processes for which I was awarded over 50 United States patents. I am the author of over 200 papers on CVD, delivered and/or published.

10. Following San Fernando Laboratories, and in partnership with Minnesota Mining and Manufacturing (3M) Company, I founded Delta G Corporation which is devoted to advancing manufacturing methods for fiber-reinforced ceramic composites as well as to improving the strength and performance thereof.

11. I have read and I understand U.S. Patent No. 6,151,887 issued November 28, 2000 to Oskar Haidn et al (hereinafter "Haidn"). I have also read and I understand the claims pending in the above-identified patent application.

12. It is my opinion that Haidn does not describe refractory fibers extending continuously between inner and outer shell walls of a rocket combustion chamber and around cooling channels formed therebetween as the means by which the inner and outer shell walls are integrally connected together.

13. It is my further opinion that Haidn employs a cooled (i.e., refrozen) molten silicon interface as the principal means for bonding the inner and outer shell walls together.

14. In particular, during the manufacturing process described by Haidn (at column 13, lines 31-48 thereof), it is stated that:

Finally, the structural unit consisting of porous C/C material and formed from the outer shell preliminary member and the inner shell preliminary member is supplied with silicon in order to create an inner shell 118 and an outer shell 120 of the combustion chamber 100 consisting of a dense, pore-free C/C – SiC material.

The supply of silicon to the structural unit preferably takes place by means of a liquid siliconizing process. In this respect, the structural unit is infiltrated with liquid silicon under vacuum at a temperature of approximately 1600° C. On account of the capillary effect, the liquid silicon passes into the pores of the porous C/C material of the inner shell preliminary member and reacts at the wetting locations not only with the residual carbon of the matrix

but also with individual carbon fiber filaments to form a ceramic silicon carbide matrix 138, into which the C/C cells or C/C strands 134 are embedded, as is apparent from FIG. 5.

15. It is my additional opinion that the infiltration of the pores in the shell of Haidn with high temperature (i.e., molten silicon) is responsible for brazing the inner and outer walls thereof together without subsequent joining steps. However, the bond of Haidn is no stronger than that of the refrozen silicon or the silicon carbide formed by the interaction of the molten silicon with the residual matrix carbon or with the carbon fibers. Such bond of Haidn is not the same as or functionally equivalent or of equal strength to the refractory fibers claimed in the above-identified patent application which extend continuously between and thereby tie together the inner and outer walls of the shell structure. In fact, I believe that the connection achieved by using the claimed continuous refractory fibers is at least 3-5 times stronger than the bond that can be achieved by Haidn.

16. Haidn suggests (at column 6, lines 38-45 thereof) that methods other than the liquid siliconizing could be used for bonding the inner and outer walls together:

In particular, the silicon can be supplied to the pyrolyzed outer shell preliminary member using a liquid siliconizing process which, in contrast to known silane processes, is particularly well suited for the siliconizing of optionally thick outer shell preliminary members.

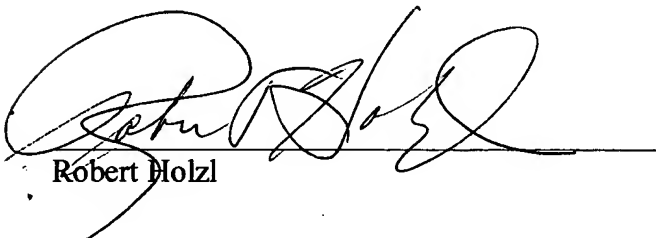
In principle, fibrous ceramics, such as, e.g., C/SiC, can also be produced, however, by way of processes such as the "liquid

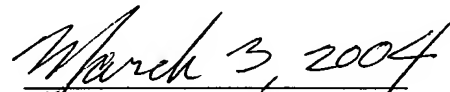
polymer infiltration” (LPI) or the “chemical vapor infiltration” (CVI).

17. It is my still further opinion that this alternate method of Haidn does not describe or suggest refractory fibers traversing the attachment surface in the manner that is claimed in the above-identified patent application.

18. In summary, I have concluded that the bonding/brazing methods described by Haidn do not use or infer refractory fibers extending continuously between inner and outer walls of a ceramic matrix composite shell structure and around a plurality of cooling channels formed therebetween to produce the unitized monocoque shell combustion chamber as that claimed in the above-identified patent application where the inner wall is fully integral with and tied to the outer wall (to prevent the inner wall from collapsing during a failure mode).

I hereby declare that all statements made herein of my own knowledge and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.


Robert Holz


Dated